Model 3121
Silicon Pyranometer

User's Manual

Rev. A

allweatherinc
All Weather Inc. • 1165 National Drive • Sacramento, CA 95834 • USA • 800.824.5873 • www.allweatherinc.com

Disclaimer
The information and specifications described in this manual are subject to change without notice.

Latest Manual Version
For the latest version of this manual, see the *User Manuals* page under *Support* on our Web site at www.allweatherinc.com/.

All Weather, Inc.
1165 National Drive
Sacramento, CA 95834
Tel.: (916) 928-1000
Fax: (916) 928-1165

Contact Customer Service

- **Phone** support is available from 8:00am - 4:30pm PT, Monday through Friday. Call 916-928-1000 and ask for "Service."
- **Online** support is available by filling out a request at www.allweatherinc.com/support/online-support/
- **E-mail** your support request to support@allweatherinc.com

Revision History

Revision	Date	Summary of Changes
A	2015 June 25	Initial release.

TABLE OF CONTENTS

1. OVERVIEW

The Model 3121 Silicon Pyranometer is a simple pyranometer for routine measurements of solar radiation. It has a conical diffuser that provides excellent directional (cosine) response, causes rain to run off and is easy to clean. Although its spectral range is limited by the photodiode detector, the performance of the Model 3121 pyranometer compares favorably to ISO 9060 Second Class thermopile pyranometers under clear and unobstructed natural daylight conditions.

The mounting flange incorporates a bubble level and adjustment screws for easy leveling. The standard cable length is 10 m.

1.1 ACCESSORIES

The following accessories and replacement parts are available for the Model 3121 Silicon Pyranometer.

Part Number	Description
M488632-00	Tower Crossarm Mounting Kit

2. THEORY OF OPERATION

The pyranometer has a silicon cell wafer as a sensing element. The silicon photovoltaic cell converts light energy directly into electrical energy. The output voltage, essentially linear with light intensity, is approximately 0.07 mV/ (W/m^2). Since this is a light-sensitive instrument, as opposed to heat-sensitive, the output response is instantaneous.

The silicon cell is mounted on a platform fitted with a bubble level and covered with a Pyrex diffuser. The volume under the glass is sealed and kept dry by means of an enclosed desiccant.

3. INSTALLATION

3.1 SITING AND INSTALLATION GUIDELINES

There are a few considerations to take into account if accurate and representative data are to be obtained.

1. Distance from Obstructions — The distance between the pyranometer and obstructions such as trees or buildings should be at least 10 times the height of the obstruction on all sides. For example, if a tree 20 m high is located alongside the sensor, the pyranometer should be at least 200 m away from the tree. This restriction reduces the effects of shade created by the nearby obstruction and makes the measurement more representative. Do not locate the sensor where tree branches or wires will hang over the pyranometer!

2. Sensor Height, Rigidity, Verticality, and Orientation — The pyranometer should be mounted at a height of 1.5 to 3 m. This height is not always possible because of constraints imposed by the site. Mounting the pyranometer lower than 1.5 m or higher than 5 m is not generally recommended.

   The pyranometer must be mounted level within ±2 degrees.

SUGGESTION: Take a picture at the installation site in each direction (north, east, south, and west) to record the topography and obstructions for future reference.

3.2 MECHANICAL INSTALLATION

1. Position the crossarm next to the tower where the crossarm will be mounted.

Figure 1. Position Crossarm for Mounting

2. Each of the two mounting braces has independent mounts so that the brace can be attached to the tower independently of positioning the crossarms in the braces. Use a carpenter's level to keep the crossarm as level as possible while securing each brace to a tower leg.

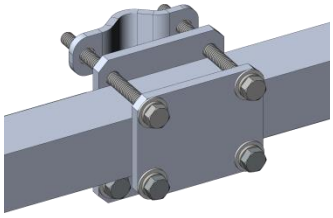

Figure 2. Mounting Brace Detail

3. Position the crossarm in the brace so that the area where the pyranometer will be mounted is at the desired distance from the tower.

4. Position the pyranometer on the mounting plate at the end of the crossarm.

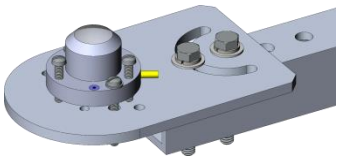

Figure 3. Mount Pyranometer

5. Orient the pyranometer with the cable pointing towards the nearest pole to minimize solar heating of the electrical connections.

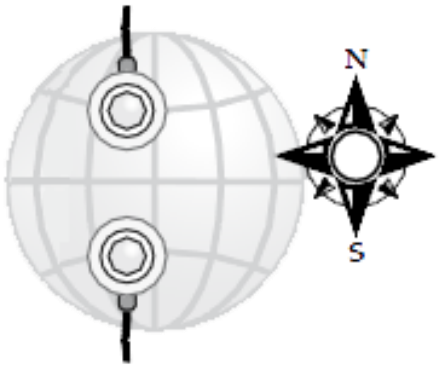

Figure 4. Pyranometer Cable Faces Nearest Pole

6. Use the two pyranometer mounting bolts supplied to mount the pyranometer securely to the mounting plate. Once it is attached securely, use the levelling screws to position the pyranometer so that the bubble in the bubble level is centered.

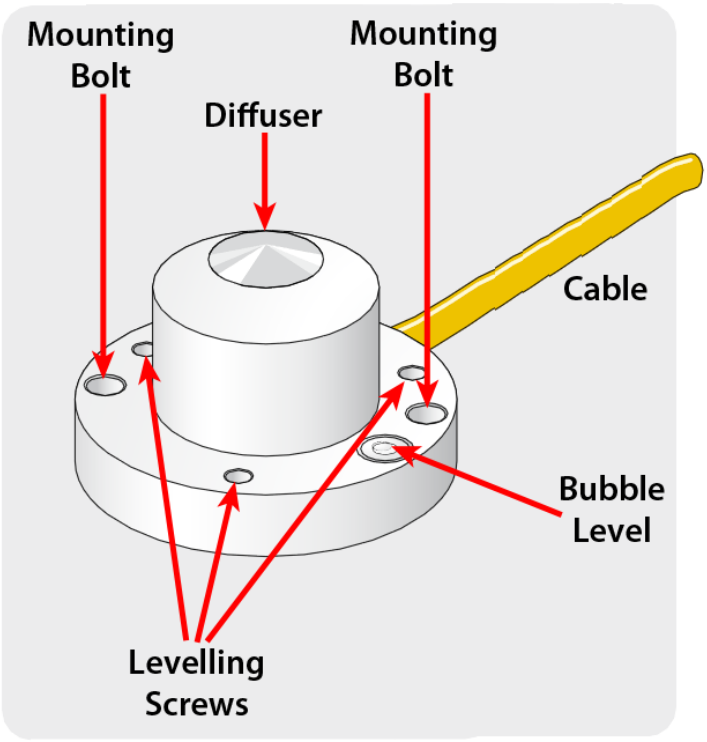

Figure 5. Pyranometer Mounting and Levelling

7. Route the pyranometer cable along the crossarm and down one of the tower legs to the Data Collection Platform (DCP) or other data acquisition system. Secure the cable every 50 cm with a UV-resistant plastic cable tie.

A low-voltage analog input module with an A/D converter must be available. The span and resolution of the A/D converter in the module must allow a system sensitivity of about 1 bit per W/m^2. More resolution is not necessary during outdoor solar radiation measurements, because pyranometers exhibit offsets up to ±2 W/m^2 because of a lack of thermal equilibrium.

3.3 ELECTRICAL CONNECTIONS

The 10 m cable has a shield and two leads.

White	+
Black	–
Shield	GND

4. MAINTENANCE

Once installed, the pyranometer requires little maintenance. Inspect and clean the diffuser monthly, preferably in the morning.

On clear windless nights, the surface temperature of the diffuser will decrease—even to the dew point temperature of the air—because if IR radiation exchange with the cold sky. (The effective sky temperature can be 30°C lower than the ground temperature, which results in an infrared emission of -150 W/m^2.) When this happens, dew, glazed frost, or hoar frost may form on the diffuser surface, and may remain there for several hours during the morning. An ice cap on the diffuser is a strong diffuser and increases the pyranometer's signal drastically, up to 50% in the first hours after sunrise.

It is possible to add a blower to ventilate the area above the diffuser and keep the temperature of the diffuser above the dew point temperature.

5. SPECIFICATIONS

Parameter	Specification
Overall Spectral Range	400 to 1100 nm
Sensitivity	60 to 100 µV/(W/m^2)
Output Impedance	50 Ω
Expected Output Range	0 to 150 mV
Maximum Operational Irradiance	2000 W/m^2
Response Time (95%)	<500 ns
Non-stability (change/year)	<2%
Non-linearity (0 to 1000 W/m^2)	<2.5%
Directional Response (up to 80° with 1000 W/ m^2 beam)	<10 W/m^2
Temperature Response	-0.15%/°C
Field of View	180°
Bubble Level Accuracy	<0.2°
Detector Type	Photo Diode
Environmental	
Operating Temperature	-40 to +80ºC
Storage Temperature	-40 to +80ºC
Relative Humidity	0–100%, noncondensing
Mechanical	
Ingress Protection Rating	IP67
Mounting	Crossarm
Dimensions	54 mm diameter × 34 mm H
Weight	0.5 kg

6. WARRANTY

Any defect in design, materials, or workmanship which may occur during proper and normal use during a period of 1 year from date of installation or a maximum of 2 years from shipment will be corrected by repair or replacement by All Weather Inc.

allweatherinc
All Weather Inc.
1165 National Drive
Sacramento, CA 95818
Fax: 916.928.1165
Phone: 916.928.1000
Toll Free: 800.824.5873